SCIENCE

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THE MOST DESTRUCTIVE TORNADOES SINCE 1872.

A GOOD many rather imperfect lists have been published from time to time, which have not had sufficient care manifested in their collation. There are several peculiar difficulties which one meets in this work. For example: each of three different men at three towns makes a report of a tornado, presumably in the town. One makes the property loss $25,000, and the number of killed, 8; while the second makes these $100,000 and 9, and the third $200,000 and 12, respectively. Fortunately a request was made for the names of the persons killed, and it was found that 8 of them were the same in all three reports, showing that the same tornado had been described. It would have been a very easy matter to have considered the loss of life 29, and of property $325,000, if these had been regarded as different. In another case there were found four tornado lists, two of them containing over 2,000 in each list. One of these was given as occurring near Erie, Penn., on July 26, 1875, in the afternoon. The condition before the storm was "very sultry," and after it, "chilly;" the destructive winds had a motion first from "south-west," then "north-west, west, and north;" while the rain was given as falling "after" the tornado. One hundred and thirty-four lives were lost, and property valued at $500,000 was destroyed. This whole account was so circumstantial and straightforward, that it was very remarkable to find no mention of such a destructive storm in the *Weather Review*. After a search of a good many days, it was at last found that this loss of life and property occurred from a flood near Pittsburgh, Penn., on July 26, 1874.

The *Weather Review* has been appealed to in determining what storms should go into the list below, as it does not appear probable that any notable tornado would be overlooked in that. The criterion for destructiveness has been not entirely the loss to structures, but the violence of the storm, the loss of life, etc., have entered into the estimate. It is not expected that this list will prove entirely satisfactory: in fact, it has already been changed slightly since its first preparation in June, 1889. The utmost pains have been taken to make it reliable, and, if there has been any error, it has been in the line of allowing too much loss rather than too little in any individual case.

(1) Nov. 22, 1874. Tuscumbia, Colbert County, Ala. (scale 3).—Struck the town at 6 P.M.; nearly half the town of 1,400 inhabitants destroyed; 10 persons killed, and 30 wounded; 100 buildings damaged or destroyed; loss, $100,000 (estimated).

(2) May 6, 1876. Chicago, Cook County, Ill. (scale 3).—Moved from south-west to north-east, accompanied by rain, thunder, and lightning; bounding like a ball, it apparently reached the ground but two or three times; loss, $250,000.

(3) June 4, 1877. Mount Carmel, Wabash County, Ill. (scale 3+).—200 to 400 feet wide; great destruction of property; 16 killed, 100 wounded; loss, $400,000.

(4) July 7, 1877. Pensaukee, Oconto County, Wis. (scale 3).—Moved from north-west to south-east, lasting about 2 minutes; 8 killed, many wounded; loss, $300,000.

(5) June 1, 1878. Richmond, Ray County, Mo. (scale 3).—Entered the town at 4.5 P.M. from the south, sweeping every thing clean; heavy sills 18 inches square and 16 feet long were swept away; path through the city 750 feet wide and 1 mile long, in which space not a single house was left; 13 killed, 70 wounded; 100 buildings damaged or destroyed; loss, $100,000 (estimated).

(6) Aug. 9, 1878. Wallingford, New Haven County, Conn. (scale 3+).—At 5.45 P.M. a dark cloud approached from the west; "electricity of the most terrific kind filled the air;" "straight rods of fire came down from the sides of the cloud to the earth; the *débris* of houses was scattered along in parallel lines, as though a mighty river had passed; the greatest destruction occurred in a path 400 feet wide and half a mile long; 34 killed, 70 wounded; 40 dwellings, 50 barns, 1 church, and 1 schoolhouse were destroyed or badly damaged; loss, $200,000.

(7) April 14, 1879. Collinsville, Madison County, Ill. (scale 3—).—Struck town at 2.45 P.M.; nearly every gravestone in cemetery was levelled; 1 killed, several wounded; 60 buildings destroyed; loss, $50,000.

(8) April 16, 1879. Walterboro, Colleton County, S.C. (scale 3).—Rainfall after tornado, which struck at 3.45 P.M., was unprecedented; wind on north side had a downward crushing tendency, on the south side an upward lifting action; 4 people saw balls of lightning running along the ground; 16 killed; 50 buildings destroyed; loss, $200,000.

(9) March 4, 1880. Indianapolis, Marion County, Ind. (scale 3—).—Moved from south-west to north-east with a zigzag course through the city; loss, $100,000.

(10) April 18, 1880. Fayetteville, Washington County, Ark. (scale 3).—Struck town at 8.30 P.M.; not a building escaped in its path, 90 feet wide, through the

town; 2 killed, 20 to 30 injured; 100 buildings destroyed; loss, $100,000.

(11) April 18, 1880. Marshfield, Webster County, Mo. (scale 3).—Struck at 5 P.M.; near town, trees 3 feet in diameter, for a space several hundred yards wide, were lifted entirely out of the ground; every house in the town of 2,000 people was destroyed or badly damaged; 65 killed, 200 wounded; loss, $110,000.

(12) April 18, 1880. Licking, Texas County, Mo. (scale 3—). —Struck at 8.15 P.M.; entire town, of 388 people, destroyed except 3 houses; 300 left homeless; 1 killed, 17 wounded; 65 houses destroyed; loss, $50,000.

(13) April 18, 1880. Beloit, Rock County, Wis. (scale 3—). —Struck at 5 P.M.; moved from south-west to north-east; several killed, many injured; many houses destroyed; loss, $75,000.

(14) April 24, 1880. Taylorville, Christian County, Ill. (scale 3—).—Struck at 7 P.M.; 6 killed; 25 houses destroyed; loss, $60,000.

(15) April 25, 1880. Macon, Noxubee County, Miss. (scale 3).—Struck at 8.30 P.M.; 22 killed, 72 injured; 55 buildings destroyed; loss, $100,000.

(16) May 10, 1880. Arrowsmith, McLean County, Ill. (scale 3—).—Loss, $100,000.

(17) May 28, 1880. Savoy, Fannin County, Tex. (scale 3—).—Time, 10 P.M.; town almost destroyed; 15 killed, 60 wounded; 48 buildings razed; loss, $50,000.

(18) June 14, 1880. Glendale, Hamilton County, O. (scale 3—).—Time, 8 P.M.; loss, $80,000.

(19) April 12, 1881. Hernando, De Soto County, Miss. (scale 3—).—In some spots hail-stones as large as hen's eggs fell; electricity and thunder not observed; 10 killed; 25 buildings demolished; loss, $50,000 (estimated).

(20) June 12, 1881. Jackson, Andrew County, Mo. (scale 3).—A great deal of destruction occurred at King City, De Kalb County; in county and vicinity, 5 killed; 80 buildings razed; loss, $250,000.

(21) July 15, 1881. New Ulm, Brown County, Minn. (scale 3+).—11 killed, 53 wounded; nearly 300 buildings destroyed or seriously damaged; loss in town, $400,000.

(22) Sept. 24, 1881. Quincy, Adams County, Ill. (scale 3).—Time, 5 P.M.; storm accompanied by terrific lightning and thunder; 9 killed; 21 buildings razed; loss, $100,000.

(23) April 18, 1882. Brownsville, Sabine County, Mo. (scale 3).—Time, 4.20 P.M.; 8 killed; 10 brick houses, 40 others, and 1 school razed; loss, $150,000.

(24) May 8, 1882. McKinney, Cleveland County, Ark. (scale 3—).—50 buildings destroyed; loss, $30,000.

(25) May 8, 1882. Mount Ida, Montgomery County, Ark. (scale 3—).—Time, 5.30 P.M.; 2 killed; 100 buildings demolished; loss, $50,000.

(26) June 17, 1882. Grinnell, Poweshiek County, Io. (scale 3+).—Time, 8.45 P.M.; 60 killed, 150 injured; 140 houses reduced to ruins in 5 minutes; loss, $600,000.

(27) April 22, 1883. Beauregard, Copiah County, Miss. (scale 3+).—Time, 3 P.M.; every house and store destroyed in the town of 600 people; solid iron screw of a cotton-press weighing 675 pounds was carried 900 feet; 29 killed, 40 wounded; loss, $450,000.

(28) April 22, 1883. Wesson, Copiah County, Miss. (scale 3—).—13 killed, 60 injured; 27 houses destroyed; loss, $20,000.

(29) May 13, 1883. Kansas City, Jackson County, Mo. (scale 3).—Time, 8.30 P.M.; 200 houses destroyed; loss in town and vicinity, $300,000.

(30) May 13, 1883. Macon City, Macon County, Mo. (scale 3—).—Time, 8.30 P.M.; 5 killed; 107 buildings razed; loss, $150,000. This destruction and loss may include the whole county.

(31) May 18, 1883. Oronogo, Jasper County, Mo. (scale 3—).—6 killed, 33 injured; nearly all houses destroyed; loss, $75,000.

(32) May 18, 1883. Racine, Racine County, Wis. (scale 3—).—Time, 7 P.M.; 16 killed, 100 injured; loss, $75,000.

(33) June 2, 1883. Greenville, Hunt County, Tex. (scale 3—).—Time, 7.15 P.M.; 1 killed, several wounded; 40 houses razed; loss, $70,000.

(34) June 11, 1883. Brush Creek, Fayette County, Io. (scale 3—).—Town one-third destroyed; loss, $40,000.

(35) Aug. 21, 1883. Rochester, Olmstead County, Minn. (scale 3).—Time, 6.36 P.M.; large part of town destroyed; 26 killed; 135 houses destroyed; loss in county, $200,000.

(36) Feb. 19, 1884. Leeds, Jefferson County, Ala. (scale 3—).—Time, 1.20 P.M.; hail of unusual size; 11 killed, 31 wounded; 27 houses and many barns destroyed; loss, $80,000 (estimated).

(37) April 27, 1884. Jamestown, Greene County, O. (scale 3).—Time, 5 P.M.; 6 killed; two-thirds of buildings destroyed; loss, $200,000.

(38) July 21, 1884. Dell Rapids, Minnehaha County, Dak. (scale 3).—Time, 3.5 P.M.; 7 killed; many buildings destroyed; loss, $100,000.

(39) Sept. 9, 1884. Clear Lake, Polk County, Wis. (scale 3). —Time, 5 P.M.; greater part of town in ruins; 3 killed; 40 buildings destroyed; loss, $150,000.

(40) Aug. 3, 1885. Camden, Camden County, N.J. (scale 3+).—Time, 3.20 P.M.; path from one to two squares wide; 6 killed, 100 injured; 500 houses razed or unroofed; loss, $500,000.

(41) Sept. 8, 1885. Washington Court House, Fayette County, O. (scale 3+).—Time, 7.30 P.M.; width of path, 250 feet; town almost destroyed; 6 killed, 100 injured; 40 business-houses and 200 residences razed; loss, $500,000.

(42) April 14, 1886. Coon Rapids, Carroll County, Io. (scale 3—).—Time, 5.5 P.M.; 1 killed; 32 buildings razed; loss, $55,000.

(43) April 14, 1886. St. Cloud, Stearns County, and Sauk Rapids, Benton County, Minn. (scale 3+).—74 killed, 136 wounded; 138 buildings destroyed; loss, $400,000.

(44) May 12, 1886. Attica, Fountain County, Ind. (scale 3).—Time, 10 P.M.; in vicinity, 9 killed; 200 houses razed; loss, $200,000.

(45) April 15, 1887. St. Clairsville and Martin's Ferry, Belmont County, O. (scale 3). Time, 3.20 P.M.; none killed; about 200 buildings of all kinds demolished; loss, $250,000.

(46) April 21, 1887. Prescott, Linn County, Kan. (scale 3). —Time, 5.30 P.M.; 20 killed, 237 wounded; 330 buildings razed in vicinity; loss, $150,000.

(47) April 22, 1887. Mount Carmel (near), Wabash County, Ill. (scale 3 —).—Time, 6 P.M.; 2 killed, several wounded; every thing in path destroyed; loss, $50,000.

(48) April 22, 1887. Clarksville (near), Johnson County, Ark. (scale 3).—Time, 6.30 A.M.; 20 killed, 75 to 100 injured in vicinity; loss, $150,000.

(49) June 16, 1887. Grand Forks, Grand Forks County, Dak. (scale 3).—Time, 3.22 P.M.; 4 killed; 50 or more houses, besides hundreds of barns, etc., razed; loss, $150,000.

(50) Feb. 19, 1888. Mount Vernon, Jefferson County, Ill. (scale 3+).—18 killed, 54 wounded; 100 buildings razed; loss, $400,000.

(51) May 27, 1888. Hillsboro, Hill County, Tex. (scale 3 —).—Many buildings razed; loss, $100,000.

(52) Aug. 21, 1888. Wilmington, New Castle County, Del. (scale 3).—1 killed, 20 wounded; loss $100,000 to $200,000.

(53) Jan. 9, 1889. Brooklyn, Kings County, N.Y. (scale 3).—Time, 7.40 P.M. (Eastern); width, 500–600 feet; length, 2 miles; whirl from right to left; roar heard 10 or 15 minutes before; loss, $300,000.

(54) Jan. 9, 1889. Reading, Berks County, Penn. (scale 3). —Time, 5.40 P.M.; swept from west to east in a path 60 to 100 feet wide; wind often seemed to crush from above; 40 killed; loss, $200,000 (estimated).

(55) Jan. 12, 1890. St. Louis, St. Louis County, Mo. (scale 3).—Time, 4 P.M.; moved to north-east in a path 500 to 2,000 feet wide; heavy rain for 3 minutes; greatest damage where path was narrowest; 3 killed; 100 houses razed; loss, $250,000.

(56) March 27, 1890, Metropolis, Massac County, Ill. (scale 3 —).—1 killed, 50 injured; loss, $150,000.

(57) March 27, 1890. Louisville, Jefferson County, Ky. (scale 3+).—Time, 7.57 P.M.; path at beginning 600 feet, as it left the city 1,500 feet; cloud did not quite reach the earth; great damage to property; 76 killed, 200 injured; loss, $2,250,000.

This list comprises all the most destructive storms that have been reported, as far as a definite locality was mentioned. It has been found exceedingly difficult to determine the loss in many cases, because an estimate has evidently been made of the loss to crops, orchards, etc., from the rain, hail, and floods that accompanied the tornado, and not from the wind itself. Again, the loss reported evidently referred to a large region in the county, and not to any specific town. Some of these may be enumerated as follows:—

DATE.	COUNTY.	STATE.	LOSS.
June 12, 1881	DeKalb and others.	Missouri.	$200,000
Nov. 5, 1883	Greene and others.	Missouri.	150,000
Nov. 21, 1883	Izard.	Arkansas.	300,000
April 14, 1886	Cass.	Iowa.	160,000
May 11, 1886	Pettis and others.	Missouri.	500,000
May 12, 1886	Greene and others.	Ohio.	1,000,000
May 14, 1886	Hardin and others.	Ohio.	720,000
May 14, 1886	Huron.	Ohio.	500,000
May 14, 1886	Seneca.	Ohio.	300,000
May 14, 1886	Mercer.	Ohio.	250,000

It is highly probable that in some of these cases the losses from one county have been estimated in another, though this has been avoided as much as possible. It is very much to be hoped that more definite estimates will be made in the future. The loss to structures by the wind should be carefully distinguished from the loss of every other kind, by hail or flood, and to crops, stock, or orchards. I shall be very grateful to any who will send me corrections to this list, or add other tornadoes. H. A. HAZEN.

LIGHTNING-CONDUCTORS FROM A MODERN POINT OF VIEW.[1]

A LIGHTNING-CONDUCTOR used to be regarded as a conduit or pipe for conveying electricity from a cloud to the ground. The idea was, that a certain quantity of electricity had to get to the ground somehow; that if an easy channel were opened for it the journey could be taken quietly and safely, but that if obstruction were opposed to it violence and damage would result. This being the notion of what was required, a stout copper rod, a wide-branching and deep-reaching system of roots to disperse the charge as fast as the rod conveyed it down, and a supplement of sharp points at a good elevation to tempt the discharge into this attractive thoroughfare, were the natural guaranties of complete security for every thing overshadowed by it. Carrying out the rain-water-pipe analogue, it was natural also to urge that all masses of metal about the building should be connected to the conductor, so as to be electrically drained to earth by it; and it was also natural to insist on very carefully executed joints, and on a system of testing resistance of conductor and "earth," so as to keep it as low as possible. If ever the resistance rose to 100 ohms, it was to be considered dangerous.

The problem thus seemed an easy one, needing nothing but good workmanship and common sense to make accidents impossible. Accordingly, when, in spite of all precautions, accidents still occurred; when it was found that from the best-constructed conductors flashes were apt to spit off in a senseless manner to gun-barrels and bell-ropes, and wire fences and water-butts,—it was the custom to more or less ridicule and condemn either the proprietor of the conductor, or its erector, or both, and to hint that if only something different had been done,—say, for instance, if glass insulators had not been used, or if the rod had not been stapled too tightly into the wall or if the rope had not been made of stranded wires, or if copper had been used instead of iron, or if the finials had been more sharply pointed, or if the earth-plate had been more deeply buried, or if the rainfall had not been so small, or if the testing of the conductor for resistance had been more recent, or if the wall to which the rod was fixed had been kept wet, etc.,—then the damage would not have happened. Every one of these excuses has been appealed to as an explanation

[1] By Professor Oliver J. Lodge (from Industries).